Navy Case No.: 84,512
301-227-1835
West Bethesda, MD

# HYDROPLANING UNMANNED SURFACE VEHICLE

## STATEMENT OF GOVERNMENT INTEREST

[0001] The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without payment of any royalties thereon or therefore.

## BACKGROUND OF THE INVENTION

[0002] The present invention relates to unmanned vehicles, and more particularly to unmanned surface vehicles (USV) designed for use in rough or calm bodies of water.

[0003] Unmanned air, ground and underwater vehicles have been developed that perform numerous tasks and have proven extremely useful. However, USVs have not been developed to the same extent.

[0004] Littoral areas of operation may be denied, inaccessible or too hazardous to operate in with manned ships. Properly designed USVs could make these areas accessible for operation. No multimission USV has been developed that can operate for extended periods of time, in different sea conditions with numerous types of payloads and sensors. The applicants have developed a novel USV system that has the built in flexibility to perform multiple missions for extended periods of time such as mine countermeasure, anti-submarine warfare, and intelligence, surveillance and reconnaissance.

## SUMMARY OF THE INVENTION

[0005] An unmanned hydroplaning water surface vehicle having a gondola housing with external lift and control foils that allow the unmanned surface vehicle (USV) to plane in water at sufficient speed. A superstructure trimaran hull serves as a stable operation platform during low speed maneuvers or at rest. The superstructure includes command and control systems that make the USV capable of remote, semi-autonomous or fully autonomous operations. A plurality of mission specific payloads and sensors are dispersed in the superstructure and gondola to allow for various types of missions. A strut would connect the gondola section and the superstructure, as well as provide for the passage of a plurality of transmission and control lines.

[0006] For a better understanding of the present invention, together with other and further objects thereof, reference is made to the following description, taken in conjunction with the accompanying drawings, and its scope will be pointed out in the appended claims.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 is a perspective view of the unmanned surface vehicle of the present invention.

[0008] FIG. 2 is a front view of the unmanned surface vehicle of the present invention.

[0009] FIG. 3 is a top view of the unmanned surface vehicle of the present invention.

[00010] FIG. 4 is a side view of the unmanned surface vehicle of the present invention.

[00011] FIG. 5 is a cut away side view illustrating the layout of components in the unmanned surface vehicle of the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

[00012] Referring now to the example of FIG. 1, the hydroplaning unmanned surface vehicle (USV) 100 includes three main sections; the gondola 102, the strut 118, and the superstructure hull 122. The gondola 102 section is connected to the superstructure hull 122 by the strut 118. The USV 100 is designed to be stable in rough seas when the craft is stationary or moving at low speeds. Once the USV 100 begins moving at high speeds the mid foils 104 and aft foils 106 lift the gondola 102 section of the USV 100 up to waterline 105 reducing waterplane area.

[00013] The gondola 102 section preferably includes a ducted propeller 108 and a pair of mid lift foils 104 and a pair of aft lift foils 106. The propulsion motor 110, shown in the example of FIG. 5, drives the ducted propeller 108 to provide thrust to the USV 100. Many different types of payloads may be carried in a bay with retractable doors (not shown) in the gondola 102. For example, the USV 100 may be outfitted as shown in FIG. 5, with a winch 114 and a towed minehunting sonar system 112. The placement of the towed system 112 is designed to be inline with the thrust vector along the centerline of the USV 100. In another embodiment the gondola 102 may include a sonar and sonar dome 116 as shown in FIG. 4. The lifting foils attached to the gondola 102 provide roll, pitch, sinkage control. Sinkage is defined as the distance between the baseline and the waterline. The main foils 104, located amidships, can be independently controlled to provide the necessary roll and sinkage control. The aft foils 106 move jointly to control the pitch and sinkage of the USV 100. Once the USV 100 reaches approximately 15 knots the foils provide enough lift so that the gondola 102 will plane to waterline 105 lifting the superstructure hull 122 out of the water.

[00014] As shown in FIG. 4, the vertical strut 118 includes a rudder 120 for both low and high speed control. To reduce drag caused by the submerged strut 118 and gondola 102 it is preferable to have a fairing 119, as illustrated in FIG. 2, to provide a smooth transition for the interface between the strut 118 and gondola 102. The fairing 119 consists of filleting the transition boundaries between the strut 118 and gondola 102. The strut 118 includes a number of passages for transmission and control lines to permit electrical power, control signals, data signals and mechanical linkages to be sent between the gondola 102, the superstructure hull 122 and the vertical strut 118.

[00015] As illustrated in the example of FIG. 2, the superstructure hull 122 is a trimaran configuration that will provide excellent stability in rough seas. The starboard outrigger houses a fuel tank 124 and deployable payloads 130 and the port outrigger also houses a fuel tank 126 and deployable payloads 132. The starboard payload bay 130 and the port payload bay 132 may be configured to accommodate numerous types of equipment such as torpedoes, sonobuoys, mine countermeasure devices, semi-autonomous undersea vehicles or fully autonomous undersea vehicles. These configurable payload bays make the USV 100 very flexible and capable of performing numerous types of missions.

[00016] As shown in the example of FIG. 5, the center portion of the superstructure hull 122 includes a generator 128 that provides power for propulsion and various types of electronic equipment. By operating on the surface of the water, the USV 100 is able to utilize conventional power sources such as diesel or gas turbine engines. This allows for up to several weeks of operational life.

[00017] The superstructure hull 122 houses most of the command, control and communication systems for the USV 100. The superstructure hull 122 includes cabinets for electronic equipment 134, various types of sensors 136 (including intelligence, surveillance, and reconnaissance or ISR sensors), and communications 138, shown in the example of FIG. 3. In the preferred embodiment the satellite communications 138 would be housed under a radome. The USV 100 would preferably be able to communicate to any combination of surface vessels, aircraft, or satellites as well as undersea assets. The electronic equipment suite 134 includes, command and control modules to permit autonomous, semi-autonomous or remote operation of the USV 100. The command and control techniques are similar to those employed in unmanned aerial vehicles (UAVs). Additionally, the electronic equipment would interface with the sensors 136 to analyze possible threats and to take the appropriate action. The superstructure hull 122 preferably is low profile to reduce signatures and to increase intact hydrostatic stability.

[00018] In operation the USV 100 would be assigned to perform one of its primary missions such as anti-submarine warfare (ASW), mine countermeasure (MCM) or intelligence, surveillance and reconnaissance (ISR). Insertion into areas where there is threat of nuclear, biological or chemical agents is even possible. The USV 100 would be able to remain at a location for up to several weeks without resupply as it utilizes conventional power sources instead of mission limiting power supplies such as batteries.

[00019] The USV 100 could perform either alone or as part of a squadron of USVs 100 could accomplish the missions identified. As part of a squadron the USVs 100 would be able to rapidly deploy at speeds up to

35 knots and patrol in a grid over a large area. Then the USV 100 could deploy a plurality of smaller unmanned undersea vehicles (UUVs) from the payload bays 130, 132 to provide extensive coverage within the grid. The USV 100 would then serve as a tender and communications hub for the UUVs to collate data and transmit information to a central location for processing the data from the squadron. Additionally, it would be possible to have the USVs determine various courses of action such as mine or submarine neutralization independently or to wait for instructions. Operating in this manner could clear an area of threats prior to manned ships transiting the area.

[00020] While there have been described what are believed to be the preferred embodiments of the present invention, those skilled in the art will recognize that other and further changes and modifications may be made thereto without departing from the spirit of the invention, and it is intended to claim all such changes and modifications that fall within the true scope of the invention.

[00021] What is claimed is: